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10/002,318	10/24/2001	David Patrick Magee	TI-32985	2991

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EXAMINER	
FLANAGAN, KRISTA M	

ART UNIT	PAPER NUMBER
2631	

DATE MAILED: 02/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/002,318	Applicant(s) MAGEE, DAVID PATRICK	
	Examiner Krista M. Flanagan	Art Unit 2631	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 October 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *22-25* is/are allowed.

6)☒ Claim(s) *1-21 and 26-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 October 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "10" and "14" have both been used to designate the entire system.

2. The drawings are objected to because the lead line for reference character 14 is incorrect. As drawn 10 and 14 both designate the system. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the examiner does not accept the changes, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

3. The attempt to incorporate subject matter into this application by reference to "The CORDIC Trigonometric Computing Technique" by Jack Volder on page 10, lines 5-7 is improper because no copy was submitted as part of the information disclosure statement.

4. The disclosure is objected to because of the following informalities: Page 7, line 6 it is the examiner's opinion that "The channel estimator 200" should read "The channel estimator 202" in accordance with the drawings and the rest of the specification.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

6. Claim 28 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. Regarding claim 28, which inherits all of the limitations of claim 26, the claim states a method for correcting a channel estimate where the step of computing the offset phasor comprises iteratively computing the offset phasor without performing a trigonometric calculation. Yet, in the previous claims and in the specification, page 3, lines 8-12 and page 4, lines 16-27, it is explicitly stated that the sine and cosine of the phasor offset are computed and that the "present invention applies to performing trigonometric functions and/or equivalents thereof [in this system and] in other systems"

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 1-21, 26, 27 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagayasu et al., US Patent No. 6,347,126.

10. Regarding claim 1, Nagayasu discloses a receiver system comprising: a channel estimator component (See figure 1) operative to process a data signal to form a current channel impulse response (See figure 1, blocks 12 and 14) and a channel estimate; and an offset phasor determiner (See figure 1, block 15 and column 8, lines 45-50) that determines an offset phasor as a function of the current channel impulse response and a previous channel impulse response; and a frequency offset corrector (See figure 1, block 11) that corrects the current channel impulse response by the offset phasor and provides a phase corrected channel impulse response to the channel estimator, such that the channel estimator determines a corrected channel estimate (See figure 1, blocks 11 and 13). Nagayasu fails to disclose a phase offset corrector that provides a phase corrected channel impulse response to the channel estimator, such that the channel estimator determines a corrected channel estimate. However, he discloses a frequency offset corrector that provides a phase corrected channel impulse response to the channel estimator, such that the channel estimator determines a corrected channel estimate. It would be obvious to one of ordinary skill in the art to use a phase corrector in place of a frequency corrector. One could be motivated to do this since phase and frequency have a linear relationship.

11. Regarding claim 2, which inherits all of the limitations from claim 1, Nagayasu discloses a system wherein the offset phasor determiner is operative to update the previous channel impulse response with the phase corrected channel impulse response (See column 8, lines 38-

45). Nagayasu does not expressly disclose a system wherein the offset phasor is operative to store the previous channel impulse response. However, one can appreciate that in order for the system to calculate the offset, it would have to "store" the previous channel impulse response.

12. Regarding claim 3, which inherits all of the limitations from claim 2, Nagayasu discloses a system wherein the offset phasor determiner is operative to determine an offset vector as a product of the previous channel impulse response and the complex conjugate of the current channel impulse response (See column 7, lines 13-24 and equation 19).

13. Regarding claim 4, which inherits all of the limitations from claim 3, Nagayasu discloses a system wherein the offset phasor is computed by iteratively rotating a pair of vectors (See column 8, lines 38-50). Nagayasu fails to expressly disclose rotating the vectors in opposite directions. However, it is known that the basic idea of CORDIC is to iteratively rotate a vector towards zero. The direction of rotation is arbitrary and can be chosen to drive either y or z towards aero. Therefore it would have been obvious to one of ordinary skill in the art to rotate the vectors in opposite directions to drive y towards zero.

14. Regarding claim 5, which inherits all of the limitations from claim 3, Nagayasu discloses a system wherein the offset phasor has a first component being the cosine of the phase offset and a second component being the sine of the phase offset (See column 14, lines 50-54. Changing from complex plane to polar, where the expression is known to use cosine and sine components).

15. Regarding claim 6, which inherits all of the limitations from claim 1, Nagayasu discloses a system wherein the channel estimate is at least partly formed from the phase corrected channel impulse response (See figure 1, blocks 12 and 14 and column 8, lines 27-38).

16. Regarding claim 7, which inherits all of the limitations from claim 1, Nagayasu discloses a system wherein the channel estimator determines an average channel impulse response (See figure 1, block 16 and column 8, lines 50-54).

17. Regarding claim 8, Nagayasu discloses a signal processing system for use in a receiver, the system comprising: a channel estimator (See figure 1) that receives a digital signal and produces a current channel impulse response, an average channel impulse response and a channel estimate; an offset phasor determiner (See figure 1, block 15 and column 8, lines 45-50) that determines an offset phasor, the offset phasor being at least partly a function of the current channel impulse response (See figure 1, block 14); and a frequency offset corrector (See figure 1, block 11) that corrects the current channel impulse response by the phase offset using the offset phasor and provides a frequency corrected channel impulse response. Nagayasu fails to disclose a phase offset corrector that corrects the current channel impulse response by the phase offset using the offset phasor and provides a frequency corrected channel impulse response. He discloses a frequency offset corrector that corrects the current channel impulse response by the phase offset using the offset phasor and provides a frequency corrected channel impulse response. It would be obvious to one of ordinary skill in the art to use a phase corrector in place of a frequency corrector. One could be motivated to do this since phase and frequency have a linear relationship.

18. Regarding claim 9, which inherits all of the limitations of claim 8, Nagayasu discloses a system wherein the offset phasor is at least partly a function of the average channel impulse response (See figure 1, block 16).

19. Regarding claim 10, which inherits all of the limitations of claim 8, Nagayasu discloses a system wherein the offset phasor is at least partly a function of a previous channel impulse response (See figure 1, block 15 and column 8, lines 45-50).

20. Regarding claim 11, which inherits all of the limitations of claim 10, Nagayasu discloses a system wherein the offset phasor determiner stores the previous channel impulse response (See column 8, lines 38-45). Nagayasu does not expressly disclose a system wherein the offset phasor is operative to store the previous channel impulse response. However, one can appreciate that in order for the system to calculate the offset, it would have to "store" the previous channel impulse response.

21. Regarding claim 12, Nagayasu discloses a system for correcting a current channel impulse response, the system comprising: a component that receives a digital signal and produces a current channel impulse response (See figure 1, blocks 11, 12 and 14); an offset phasor determiner (See figure 1, block 15) that provides an offset vector that is a function of the current channel impulse response and a previous channel impulse response, the offset phasor determiner iteratively computes the sine and cosine of the phase offset from the offset vector (See column 7, lines 13-24); and a phase offset corrector (See figure1, block 11) that forms a phase corrected channel impulse response from the current channel impulse response and the offset phasor. Nagayasu does not expressly disclose performing an IFFT on the data bursts to obtain a channel impulse response or an FFT to transform the phase corrected channel impulse response into a portion of a channel estimate. However, it would be apparent to one of ordinary skill in the art that a signal can be represented as a function of time *t* or as a function of

frequency *f*. One would be motivated to switch between the two representations by applying the fast Fourier transform or inverse fast Fourier transform.

22. Regarding claim 13, which inherits all of the limitations of claim 12, Nagayasu discloses a system wherein the offset vector is formed as a product of the previous channel impulse response and the complex conjugate of the current channel impulse response (See column 7, lines 13-24).

23. Regarding claim 14, which inherits all of the limitations of claim 13, Nagayasu discloses a system wherein the sine and cosine of the phase offset is iteratively computed using a first vector and a second vector (See column 7, lines 13-24).

24. Regarding claim 15, Nagayasu discloses a system for determining a phase corrected channel impulse response, the system comprising: a comparator (See block 15 column 7, lines 13-24) that computes an offset vector as a function of a current channel impulse response and a second channel impulse response, the offset vector representing a phase offset of the current channel impulse response with respect to the second channel impulse response; a vector analyzer (See block 15) that computes an offset phasor as a function of the offset vector, the offset phasor having an imaginary component corresponding to the sine of the phase offset and a real component corresponding to the cosine of the phase offset; and a frequency offset corrector (See block 11, where the frequency corrector of Nagayasu has a linear relationship with a phase corrector of the current application.) that computes a corrected channel impulse response using the offset phasor.

25. Regarding claim 16, which inherits all of the limitations of claim 15, Nagayasu discloses a system wherein the second channel impulse response is one of an average channel impulse response and a previous channel impulse response (See figure 1, block 16).

26. Regarding claim 17, which inherits all of the limitations of claim 15, Nagayasu discloses a system wherein the comparator computes the offset vector as a product of the second channel impulse response and a complex conjugate of the current channel impulse response (See column 7, lines 13-24).

27. Regarding claim 18, which inherits all of the limitations of claim 15, Nagayasu discloses a system wherein the offset phasor being computed without computing the angle of the offset vector (See figure 1, block 15 and column 8, lines 45-50 where there is no mention of computing a start angle).

28. Regarding claim 19, which inherits all of the limitations of claim 15, Nagayasu discloses a system wherein the phase offset corrector corrects the current channel impulse response by the phase offset using the offset phasor (See figure 1, block 11).

29. Regarding claim 20, Nagayasu discloses a wireless communication system comprising; means for producing a current impulse response; means for determining an offset phasor; and means for correcting the current impulse response using the offset phasor (See figure 1 and column 4, lines 7-37).

30. Regarding claim 21, which inherits all of the limitations of claim 20, Nagayasu discloses a wireless communication system wherein the means for determining an offset phasor comprises means for providing an offset vector as a function of the current impulse response and a previous

impulse response and means for computing the offset phasor from the offset vector (See column 7, lines 13-24).

31. Regarding claim 26, Nagayasu discloses a method for correcting a channel estimate comprising: receiving a data burst; obtaining a channel impulse response (See figure 1, block 14); comparing the current channel impulse response to a previous channel impulse response (See figure 1, block 15); computing an offset vector from the current channel impulse response and the previous channel impulse response (See column 7, lines 13-24); computing an offset phasor from the offset vector (See column 7, lines 13-24); correcting the current channel impulse response using the offset phasor to form a phase corrected channel impulse response (See figure 1, block 11); and forming a channel estimate from the phase corrected channel impulse response (See figure 1, block 13). Nagayasu does not expressly disclose performing an IFFT on the data bursts to obtain a channel impulse response. However, it would be apparent to one of ordinary skill in the art that a signal can be represented as a function of time *t* or as a function of frequency *f*. One would be motivated to switch between the two representations by applying the Fourier transform or inverse Fourier transform. Therefore it would have been obvious to one of ordinary skill in the art to perform an IFFT on the data bursts to obtain a channel impulse response.

32. Regarding claim 27, which inherits all of the limitations of claim 26, Nagayasu discloses a method for correcting a channel estimate (See column 8, lines 38-50). Nagayasu does not expressly disclose a method for forming the channel estimate comprising performing an interpolation using the phase corrected channel impulse. However, it would be apparent to one of ordinary skill in the art that a signal can be represented as a function of time *t* or as a function

of frequency *f*. One would be motivated to perform an interpolation to switch between the two representations by applying the Fourier transform or inverse Fourier transform.

33. Regarding claim 29, which inherits all of the limitations of claim 26, Nagayasu discloses a method for correcting a channel estimate where the step of computing the offset phasor comprises iteratively computing the offset phasor without use of a start angle (See column 8, lines 38-50).

Allowable Subject Matter

34. Claims 22-25 are allowed.

35. Regarding claim 22, subject matter, allowable over prior art, is highlighted. "A method for determining an offset phasor comprising: providing a first channel impulse response and a second channel impulse response forming an offset vector as a function of the first channel impulse response and the second channel impulse response, where the offset vector has an x coordinate and a y coordinate; **initializing a first vector having an x component and a y component with a constant value for the x component and with a zero value for the y component; initializing a second vector having an x component and a y component with the x and y coordinates of the offset vector, respectively', incrementally rotating the first vector until the y component of the second vector is about zero; concurrent to rotating the first vector, incrementally rotating the second vector in an opposite direction of the first vector until the y component of the second vector is about zero; and providing an offset phasor being final components of a last iteration of the first vector**, the x component being the cosine of the angle formed by the offset vector and the y component being the sine of the angle formed by the offset vector."

36. Claim 23 is allowable as being dependant upon claim 22.

37. Claim 24 is allowable as being dependant upon claim 22.

38. Claim 25 is allowable as being dependant upon claim 22 as well as containing subject matter, allowable over prior art, which is highlighted. "The method of claim 22, **incrementally rotating the first and the second vector comprises incremental rotations capable of being performed by a shift operation.**"

Conclusion

39. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Smith et al., US Patent No. 4,447,910 discloses a phase tracking correction scheme for high frequency modem.

b. Shiino et al, US Patent No. 5,751,776 disclose a receiver for digital communications systems.

c. Van de Beek et al., US Patent No. 6,628,926, discloses a method for automatic frequency control.

d. Vihriala, US Patent Publication No. 2002/0045433, discloses a method and arrangement for reducing frequency offset in a radio receiver.

40. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Krista M. Flanagan whose telephone number is (571) 272-2203. The examiner can normally be reached on Monday - Friday, 7 - 3:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad H. Ghayour can be reached on (571) 272-3021. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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